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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/895,152	07/02/2001	David R. Brown	2119-0160P	9526

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Patent Administrator  
Mems Optical, Inc.  
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EXAMINER

CHACKO DAVIS, DABORAH

ART UNIT

PAPER NUMBER

1756

DATE MAILED: 07/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/895,152

**Applicant(s)**

BROWN ET AL.

**Examiner**

Daborah Chacko-Davis

**Art Unit**

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 April 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4, 6-25, 27, 28 and 36-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-25, 27, 28 and 36-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>04/04</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-4, 6-7, 23-25, 27-28, are rejected under 35 U.S.C. 102(e) as being anticipated by U. S. Patent No. 6,411,642 (Mazed).

Mazed, in col 2, lines 50-55, in col 7, lines 37-59, in col 8, lines 1-57, discloses a method for fabricating a mask comprising coating a phase-shift blank (substrate) with a light sensitive material such as photoresist, performing multiple passes (at least four passes constitutes four exposed regions such that no two passes write along the same path) onto the photoresist to form a desired pattern on the photoresist and developing the photoresist layer (claims 1, 3-4, and 23-25). Mazed, in col 29-38, discloses that the photoresist material is developed and subsequently etched (claims 2, and 27). Mazed, in col 8, lines 8-14, discloses that the photoresist is exposed by performing multiple passes using electron beam lithography (claim 6). Mazed, in col 8, lines 10-14, discloses that the stitching error and non-uniformity is reduced (claims 7, and 28).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 8-22, and 36-42, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,411,642 (Mazed) in view of U. S. Patent No. 6,071,652 (Feldman et al)).

Mazed, in col 2, lines 50-55, in col 7, lines 4-13, and lines 37-59, in col 8, lines 1-57, discloses a method for fabricating a mask comprising coating a phase-shift blank (substrate) with a light sensitive material such as photoresist, performing plurality of passes (at least four passes constitutes four exposed regions such that no two passes write along the same path) by direct writing onto the photoresist to form a desired pattern on the photoresist and to reduce non-uniformity and stitching errors, and developing the photoresist layer. Mazed, in col 29-38, discloses that the photoresist material is developed and subsequently etched. Mazed, in col 7, lines 4-15, discloses that the grating patterns are exposed onto the wafer through a mask (claims 8, 10-11, 21-22, 36-38, 40). Mazed, in col 8, lines 39-48, in col 10, lines 65-67, and in col 11, lines 1-23, discloses that the exposed photoresist is developed and etched to form a grating of finer pattern on the substrate (microstructure) (claim 9). Mazed, in col 10, lines 1-5 discloses that the photoresist is heated for about an hour. Mazed, in col 8,

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lines 8-14, discloses that the photoresist is exposed by performing multiple passes using electron beam lithography (claim 41).

The difference between the claims and Mazed is that Mazed does not disclose that a portion of the photosensitive material is melted to reduce roughness error. Mazed does not disclose that the step of melting comprises a step of heating the photosensitive material for a period of time (claim 12). Mazed does not disclose the photoresist material is heated to about 80 to 170°C (claim 13). Mazed does not disclose that the photoresist material is heated to about 60-90°C (claim 14). Mazed does not disclose that the photosensitive material is positioned upside down near a heat source such as a hot plate during the step of melting (claim 15-16). Mazed does not disclose that the step of melting includes flowing a hot fluid or solvent vapor across the surface of the photosensitive material (claims 17, and 39). Mazed does not disclose that a gray scale lithography such as a half tone process or a modulated exposure masking process is performed (claims 18-20). Mazed does not disclose that the depth of melting is determined as the root mean square of roughness of the surface layer (claim 42).

Feldman, in the abstract, and in col 8, lines 7-22, discloses that the photoresist is heated to about 115°C so as to cause a reflow in the photoresist (melting) to eliminate roughness, wherein the reflow (melting of the photoresist) is performed to eliminate obvious discontinuities on the surface of the photoresist. Feldman, in col 2, lines 43-49, in col 3, lines 20-23, and lines 32-40, and in col 4, lines 45-48, discloses that photoresist can be exposed (to form a pattern) using gray scale lithography, wherein the gray scale

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lithography can be performed using a mask from half-toning or using a mask having a variable amplitude transmission with continuous level phase transmission (modulated).

Therefore, it would be obvious to a skilled artisan to modify Mazed by employing the thermal treating temperature for the heat treatment process and the gray scale masks suggested by Feldman because Feldman, in col 4, lines 64-67, discloses that employing the gray scale mask enables the control of the light passing there through in a single structure of the mask, and in col 8, lines 7-14, discloses that heating to the temperature suggested for the thermal treatment process results in the elimination of obvious discontinuities existent in the photoresist layer.

### ***Response to Arguments***

5. Applicant's arguments filed on April 8, 2004, have been fully considered but they are not persuasive. The 102 and 103 rejections made in the previous office action are maintained.

A) Applicants argue that Mazed does not disclose performing multiple passes in multiple region and that each writing pass is offset such that no two passes write along the same path.

Mazed, in co 7, lines 51-54, in col 8, lines 8-11, and in figure 3C, discloses performing multiples passes such that each pass is offset, and each pass is performed in a different region (references 130a-1, 130a-2, etc).

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B) Applicants argue that Mazed uses a step profile and not a gray scale process and therefore would not be obvious to replace the step profile of Mazed with the continuous profile (gray scale mask utilized) of Feldman.

Feldman was depended upon to provide the teaching of gray scale lithography process. Although Mazed does not teach gray scale lithography, Feldman, in col 3, lines 31, discloses that gray scale lithographic processes can be substituted with direct exposure processes such as electro-beam lithography or laser beam lithography.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If

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attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcd

  
July 6, 2004.

  
**JOHN A. MCPHERSON**  
PRIMARY EXAMINER